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Indian Standard

SPECIFICATION FOR LINE OUTPUT TRANSFORMERS (EHT) USED WITH TV PICTURE TUBES

PART I GENERAL REQUIREMENTS AND TESTS

UDC 621·397·331·24 : 621·314·228

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Indian Standard

SPECIFICATION FOR LINE OUTPUT TRANSFORMERS (EHT) USED WITH TV PICTURE TUBES

PART I GENERAL REQUIREMENTS AND TESTS

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Indian Standard

SPECIFICATION FOR LINE OUTPUT TRANSFORMERS (EHT) USED WITH TV PICTURE TUBES

PART I GENERAL REQUIREMENTS AND TESTS

0. FOREWORD

0.1 This Indian Standard (Part I) was adopted by the Indian Standards Institution on 16 April 1981, after the draft finalized by the Transformers and Inductors for Electronic Equipment Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 The object of this standard is to establish uniform requirements for the electrical mechanical and climatic properties and test methods for line output transformers used with TV picture tubes.

0.3 Individual specifications for different types of line output transformers which shall cover the requirements appropriate to the type of the line output transformers, shall form other parts of the series of standards.

0.4 This standard requires reference to IS : 589-1961* as far as the details of the climatic and mechanical testing procedures are concerned. Only the relevant degrees of severity have been specified in this standard.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part I) deals with the general requirements and methods of tests for judging the mechanical, electrical and environmental properties of line output transformers primarily intended for use with TV picture tubes.

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*Basic climatic and mechanical durability test for components for electronic and electrical equipment (*revised*).

†Rules for rounding off numerical values (*revised*).

2. TERMINOLOGY

2.0 For the purpose of this standard the following definitions shall apply.

2.1 Routine Tests — Tests carried out on each line output transformer to check the requirements which are likely to vary during production.

2.2 Acceptance Tests — Tests carried out on line output transformers selected from a lot for the purpose of acceptance of the lot.

2.2.1 Lot — All line output transformers of the same type, category and rating manufactured by the same factory during the same period using the same process and materials.

2.3 Type Tests — Tests carried out to prove the conformity with the requirements of this standard. These are intended to prove the general qualities and design of a particular type of line output transformer.

2.4 Type — A type comprising products having similar functions manufactured by the same techniques and falling within the manufacturer's usual range of ratings for these products.

NOTE 1 — Mounting accessories are ignored, provided they have no significant effect on the test results.

NOTE 2 — Ratings cover the combination of:

a) Electrical rating (*see* the relevant parts dealing with individual types of components),

b) Size, and

c) Environmental group.

2.5 Line Output Transformer (EHT) — The transformer provides the required scanning amplitude for picture tubes in television receivers. They allow the circuit to recover part of the energy expended in the deflection coil during the fly back time to generate the triangular voltage waveframe needed to produce the increasing magnetic field that moves the electron beam from left to right across the tube face. The deflection coil is connected in shunt across the autotransformer secondary.

The transformer is wound on ferrite magnetic core and has primary, secondary and auxiliary windings. Each transformer is intended for use in a particular application circuit with specified deflection unit, linearity control unit and other components.

2.6 Flyback Period — The period during which the electron beam returns to the same side of the picture tube screen to scan the next line after sweeping across a horizontal line is known as the horizontal flyback period. The period during which the electron beam returns to the starting position on the picture tube screen after completing vertical scanning is known as the vertical flyback period.

2.7 Tuning of the Leakage Inductance — Neglecting the self-inductance and capacitance transformed from the primary circuit to the secondary circuit via inductive coupling, the secondary resonant circuit during flyback in the primary circuit is formed by leakage inductance of EHT winding relative to the primary and the capacitance of the EHT winding. One of the main objects of tuned leakage inductance is the prevention of interfering oscillations during the scan. The resonant circuit is tuned to the flyback period in such a way that the parasitic oscillation which is generated in this circuit at the beginning of the flyback is cancelled out again during the second half of the flyback. In principle, a number of tuning frequencies are possible but only the lowest is accompanied by advantages and is used in practice. It has been found that the tuning frequency of this resonant circuit must be nearly three times as high as that of the primary resonant circuit which determines the flyback period. This is known as Third Harmonic Tuning.

2.8 Deflection Sensitivity — Amount of electron beam deflection per milliampere of current caused to flow through the coil when the specified accelerating voltage is applied.

NOTE — Increase in deflection sensitivity caused by decreasing EHT voltage must be compensated by decrease in deflection current as this will depend on EHT load. As angle of deflection is more or less proportional to deflection current and is inversely proportional to square root of EHT voltage, a constant ratio is generally maintained between these two quantities even with large fluctuations of brightness.

2.9 Internal Impedance of the EHT Source — The impedance due to the internal resistance of EHT rectifier, leakage inductance between the EHT winding and the primary, the internal resistance of the primary part of circuit including the internal resistance of the output valves and the internal resistance of the power source, constitute the internal impedance of the EHT source.

NOTE — Attempts are always made to obtain a low internal impedance to obtain the advantage that the EHT voltage can be maintained better with large load currents and as a result greater brightness and better focussing are obtained with a large beam current.

3. TYPE DESIGNATION

3.1 The type designation used shall be abbreviations to identify a particular type of line output transformer and shall comprise the following as given in the example below:

Example	LOT IS
LOT	denotes line output transformer.
1	represents TV picture tubes of sizes 470 mm, 510 mm, 590 mm, and 610 mm.
S	denotes solid state circuitry.

3.2 The type designation of a particular line output transformer shall be specified in the relevant specification.

4. CLIMATIC SEVERITY

4.1 The line output transformer shall be subjected to the following climatic severity.

CLIMATIC TEST (*see* IS : 589-1961*)	
Dry heat	+70°C
Cold	—10°C
Damp heat (long term)	21 days
Damp heat (accelerated)	2 cycles
Low air pressure	60 kPa

NOTE —Higher severity may be specified if so required for specific application in the relevant specification.

5. MATERIALS, CONSTRUCTION AND WORKMANSHIP

5.1 Materials — The components shall be constructed from materials free from flaws and other defects. As far as practicable, materials used for construction shall be non-flammable, non-explosive and non-corrosive.

5.2 Terminations — Line output transformers shall be provided with screws, lugs, tags, leads or plug-in-lead type terminations.

NOTE — Lugs if used shall be secured in such a way that they do not rotate or work loose or break away in normal use.

5.3 Screws, Nuts and Washers — All screws, nuts and washers, including lock washers shall be of standard sizes and thread (*see* IS : 4218-1968†) and of corrosion resistance material.

5.4 Finish — All exposed metal parts, such as edges of laminations, brackets and other hardware, shall be plated, painted or otherwise protected to prevent corrosion.

5.5 Workmanship — All parts of the line output transformer shall be manufactured in a thoroughly workmanlike manner and in accordance with good engineering practice.

---

*Basic climatic and mechanical durability tests for components for electronic and electrical equipment (*revised*).

†ISO metric screw threads.

6. MARKING

6.1 Each line output transformer shall be marked with the following minimum information :

a) Type designation and manufacturer's name or trade mark, and
b) Manufacturer's code or batch number.

6.2 In all cases the carton shall carry the following minimum information :

a) Type designation and manufacturer's name or trade mark,
b) Manufacturer's code or batch number,
c) Terminal identification, and
d) Recommended application circuit schematic the line output transformer is designed for satisfactory operation.

6.3 Data sheet giving the following minimum information shall be supplied :

a) Winding/termination identification and schematic diagram;
b) Ratings, namely, inductance, dc resistance; and
c) Other performance ratings.

6.4 The markings shall be such as not to become illegible while in storage and during service through normal handling.

6.5 Any additional marking shall be so applied that no confusion may arise.

6.6 The line output transformers may also be marked with ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

7. TESTS

7.1 General Conditions for Tests

7.1.1 *General* — Tests shall be carried out on the line output transformers as received from the manufacturer or supplier.

7.1.2 *Atmospheric Conditions for Testing* — Unless otherwise specified, all tests shall be carried out under standard atmsopheric conditions specified in IS: 589-1961*.

7.1.3 *Preconditioning* — Before measurements are made the line output transformers shall be stored at the measuring temperature and relative humidity for a time sufficient to allow the entire component to reach these conditions. The recovery period called for after conditioning is adequate for this purpose.

7.1.4 *Correction to be Applied* — When measurements are made at an ambient temperature other than the reference temperature, the results shall, where necessary, be corrected to the reference temperature. The ambient temperature during the test shall be stated in the test report.

7.1.5 *Other Precautions* — During measurements the line output transformers shall not be exposed to draughts, direct sun rays or other influence likely to cause errors.

7.1.6 *Test Frequency* — When a test frequency is specified with no tolerance, the frequency used shall be within 1 percent of the specified value.

7.1.7 *Test Voltage* — The test voltages shall be sufficiently free of distortion and noise to such a degree as not to produce any false or spurious indications.

7.2 Classification of Tests

7.2.1 *Type Tests* — The procedure for type approval shall be in accordance with IS : 2612-1965†:

a) *Number of samples* — The number of samples for type tests shall be 12 of same code number unless otherwise stated in the relevant specification.

b) *Sequence of type tests* —The sequence of type tests shall be in accordance with Table 1 unless otherwise specified in the relevant specification.

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*Basic climatic and mechanical durability tests for components for electronic and electrical equipment (*revised*).

†Recommendation for type approval and sampling procedures for electronic components.

TABLE 1 TYPE TESTS

(*Clause* 7.2.1)

GROUP (1)	NO. OF SPECIMEN (2)	TITLE OF TEST (3)	CLAUSE NUMBER (4)
0	All	Visual examination	7.3.1
		Dimensions	7.3.2
		Continuity of winding	7.4.1
		DC resistance	7.4.2
		Inductance	7.4.3
		Voltage proof	7.4.4
		Insulation resistance	7.4.5
		Induced high voltage	7.4.6
		Dynamic performance	7.4.7
1	3	Soldering	7.5
		Robustness of termination	7.6
		Bump (when specified)	7.7
		Vibration	7.8
		Shock (when specified)	7.13
		Acceleration (when specified)	7.14
		Climatic	7.9
2	3	Damp heat (long term exposure)	7.10
3	3	Endurance (electrical)	7.15
		Flammability	7.16
4	1	Mould growth	7.11
5	1	Temperature-rise	7.4.8
6	1	Salt mist	7.12

7.2.2 *Routine Tests* — The routine tests shall be performed in the following order :

Title of Test	*Clause Number*
Visual examination	7.3.1
DC resistance	7.4.2
Inductance	7.4.3
Voltage proof	7.4.4
Insulation resistance	7.4.5
Induced high voltage	7.4.6
Dynamic performance	7.4.7

7.2.2.1 If during routine tests more than 10 percent of the lot fails, the entire lot may be rejected.

7.2.3 *Acceptance Tests* — The acceptance tests shall be carried out on a limited number of samples selected in accordance with the sampling procedure given in IS : 2612-1965* and which have passed the routine tests as specified in 7.2.2.

Two groups of samples, group A and group B, shall be selected and each group shall be subjected to the tests specified in the order in Table 2 unless otherwise specified in the individual relevant specification.

TABLE 2 ACCEPTANCE TESTS

Title of Test (1)	Clause Number (2)	*AQL (Percent Defective) (3)	Inspection Level (4)	D/N† (5)
GROUP A TEST				
Dimensions	7.3.2			
Continuity of Winding	7.4.1	1 percent	II	N
DC resistance	7.4.2			
Inductance	7.4.3			
Voltage proof	7.4.4			
Insulation resistance	7.4.5			
Induced high voltage	7.4.6			
GROUP B TEST				
Sub-group B1				
Dynamic performance	7.4.7	4 percent	S3	N
Sub-group B2				
Robustness of termination	7.6	4 percent	SC	D
Bump	7.7			
Climatic	7.9			
Visual examination	7.3.1			

*IS : 2500 (Part I)-1973 Sampling inspection tables : Part I Inspection by attributes and by count of defects (*first revision*)

†D=Destructive; N=Non-Destructive.

7.3 General Tests

7.3.1 *Visual Examination* — The line output transformers shall be visually examined for workmanship, finish, condition and marking and these shall be satisfactory.

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*Recommendation for type approval and sampling procedures for electronic components.

7.3.2 *Dimensions* — The dimensions shall be checked for compliance with those specified in the relevant specification and as per manufacturer's drawings where in the requirements are not covered.

7.4 Electrical Tests

7.4.1 *Continuity of Winding* — Each winding of the line output transformer shall be tested for electrical continuity by any suitable method. Each winding shall be continuous.

7.4.2 *DC Resistance* — The dc resistance shall be measured with a resistance bridge or other suitable test equipment. The test current through the specimen shall be as small as practicable considering the sensitivity of the indicating instruments, unless the current or voltage is specified. When it is important that the temperature of the specimen shall not rise appreciably during measurement, the test voltage shall be applied uninterruptedly for as short a time as practicable, but in no case for more than 5 seconds, unless otherwise specified. The measurement shall be made at or corrected to 25° C.

The value shall be within the tolerance limits as specified.

7.4.3 *Inductance* — The winding, whose inductance is to be measured is connected as shown in Fig. 1 with an external capacitor of value C_1 across it. The resonance frequency f_1 of the circuit is measured by varying the frequency of the RF signal generator for maximum deflection on the electronic voltmeter. The value of the external capacitor is changed to C_2 and the new resonance frequency f_2 is determined. The inductance L of the winding is then given by

$$L = \frac{f^2_2 \sim f^2_1}{4\pi^2 f^2_1 f^2_2 (C_1 \sim C_2)}$$

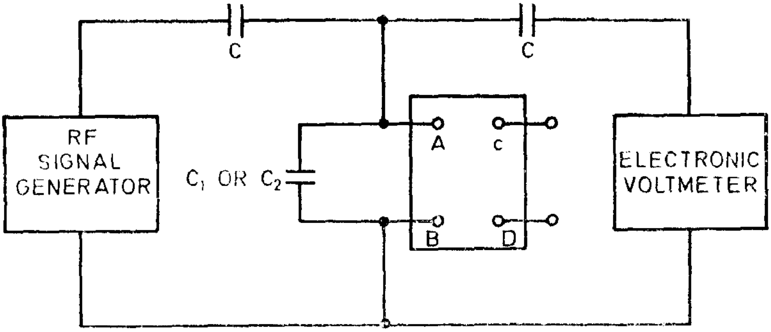

FIG. 1 SETUP FOR THE MEASUREMENT OF INDUCTANCE

7.4.3.1 Alternatively, inductance may be measured by a suitable inductance bridge of sufficient accuracy. The value shall be within limits specified in the relevant detail specification.

7.4.4 *Voltage Proof* — Unless otherwise specified the line output transformers shall withstand without breakdown the application of an ac test voltage of the value shown as under :

Maximum Working Voltage	*Test Voltage*
25 and below	50
Over 25 up to 50	100
Over 50 up to 100	300
Over 100 up to 175	500
Over 175 up to 700	2·8 × Maximum working voltage
Over 700 and above	1·4 × Maximum working voltage +1 000

Specimens shall be mounted by normal means. The test voltage shall be applied between windings and the case, if any. The voltage shall be raised at a rate not exceeding 500 V per second and shall be maintained at the maximum value for 1 minute. All windings not under test shall be connected to the case.

When this test is carried out as a routine test, the voltage shall be applied for 5 seconds only. The maximum peak voltage between terminals of line and field coils at 50 Hz shall be 2 500 V.

7.4.5 *Insulation Resistance* — Unless otherwise specified, the insulation resistance shall be measured by applying dc test voltages as mentioned below for one minute ±5 seconds between the case and each winding and also between windings, if applicable. The voltage shall not be applied gradually but shall be applied immediately through the internal resistance of the test apparatus. The insulation resistance shall be read after one minute ±5 seconds.

Maximum Working Voltage	*Test Voltage*
25 and below	50
Over 25 up to 175	100
Above 175	500

The insulation resistance shall not be less than 1 000 M Ω.

7.4.6 *Induced High Voltage Test* — A pulse voltage of specified pulse width and repetition frequency without saturating the line output transformer is applied to one of the windings to enable 1·2 times the EHT be induced in the EHT winding, and kept for 4 minutes. The low voltage end of the EHT winding should be grounded during this test. There shall be no corona, external flashover and break down during the test.

At the end of the test the line output transformer shall be tested for the following :

a) *Insulation resistance* — There shall not be any change from the valves observed earlier.

b) Each winding of the component shall be tested for electrical continuity by any suitable method. Each winding shall be continuous.

7.4.7 *Dynamic Performance Test* — The line output transformer shall be connected into a standard receiver or monitor in conformance of IS : 4547-1978* with its associated standard deflection unit as per relevant application circuit. The measurements are made using a suitable oscilloscope hv probe, voltmeters and ammeters. The electrical performance data to be measured along with the typical values to be realised are given under "Dynamic Performance Data" under relevant detail specifications.

The peak ac voltages shall be measured either by means of an oscilloscope or with a peak to peak detector as shown in Fig. 2.

The EHT voltage shall be measured at the anode terminal of the picture tube.

The flyback ratio should be computed from the observed pulse width and pulse repetition frequency as observed on the oscilloscope.

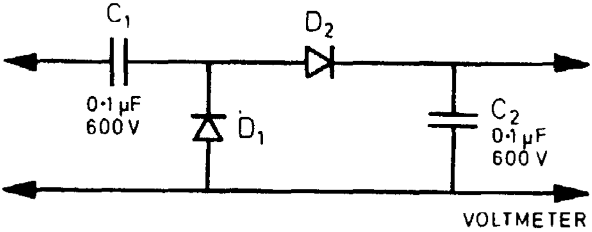

FIG. 2 PEAK TO PEAK DETECTOR

7.4.8 *Temperature-Rise* — This test shall be carried out at a temperature not exceeding the upper category temperature. The line output transformer shall be mounted so as to be protected from draughts and shall not be subjected to radiations from warmer objects. The thermometer

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*Specification for receivers for monochrome television broadcast transmissions (*first revision*)

(which may be of thermocouple type) used for measuring the ambient temperature shall be protected against trivial temperature changes by means of an oil bath or any other suitable thermal relay device.

The cold resistance of the windings shall be measured after conditioning the line output transformer for at least 8 hours until three consecutive temperature readings taken at 30 minutes interval are constant and this constant temperature shall be taken as the reference temperature T_1.

The line output transformer shall be included as part of the application circuit for functional assessment with full brightness for a period of 8 hours. The input voltages to the test apparatus shall be adjusted to be within specified limits. The hot resistance of the winding shall be measured within one minute after the completion of the test run.

The temperature rise of the transformer shall be computed by subtracting the temperature of the ambient air T_1 around the transformer from the temperature of the hottest winding T_2 using the formula.

$$\frac{R_1}{R_2} = \frac{1+\alpha T_1}{1+\alpha T_2}$$

where α = temperature coefficient of the material of the winding wire

R_1 = DC resistance at T_1°C

R_2 = DC resistance at T_2°C

The temperature-rise shall not exceed the value stated in the relevant specification.

NOTE — The temperature-rise of any winding or section shall not exceed the value ($X - Y$) where X is the temperature corresponding to the class of the insulation (*See* IS : 1271-1958*) after allowing for hot spot temperature and Y is the upper category temperature.

7.5 Soldering

7.5.1 Line output transformer shall be subjected to solder-bath test in accordance with **7.18.2** of IS : 589-1961†. The period of recovery after the immersion of the termination shall be 30 minutes unless otherwise specified in the relevant specification.

7.5.2 At the end of the test, the line output transformer shall be visually examined. There shall be no loosening of connection, melting or seepage of seating material or any other deterioration. The continuity of all windings shall be checked.

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*Classification of insulating materials for electrical machinery and apparatus in relation to their thermal stability in service.

†Basic climatic and mechanical durability tests for components for electronic and electrical equipment (*revised*).

7.6 Robustness of Termination

7.6.1 *Tensile Test on all Terminations* — All terminations shall be subjected to the test in accordance with **7.19.1** of IS : 589-1961*. The loading weight, the duration of the test and the number of bends shall be as specified in the relevant specification. In the case of the tag terminations, the tests shall be carried out in accordance with **7.19.2.3** of IS : 589-1961*.

7.6.2 There shall be no sign of fracture, loosening of parts or any other mechanical failure. The continuity of all windings shall be checked.

7.7 Bump

7.7.1 The line output transformer shall be mounted as specified in **7.5.1.6** of IS : 589-1961* taking care that the terminations are not stressed and that equal number of samples are bumped in each of the three principal axes. Samples shall be subjected to 1 000 bumps for 10 g. After the test, the line output transformer shall be visually examined and shall not show any damage or deterioration.

7.7.2 The continuity of the winding shall be checked.

7.8 Vibration

7.8.1 The line output transformer shall be mounted as required in **7.7** so that equal number of samples are vibration (fatigue) tested in accordance with **7.6.6** of IS : 589-1961*. The vibration severity should be 10 to 55 Hz with duration of six hours.

7.8.2 After this test the line output transformer shall be visually examined and there shall not be any damage or deterioration. The continuity of the winding shall be checked. The dc resistance and inductance shall be measured and should be within specified limits. Voltage proof test shall be carried out. There shall also be no change in insulation resistance when measured at the end of this test.

7.9 Climatic Tests

7.9.1 *Climatic Sequence*

7.9.2 *Dry Heat* — The line output transformer shall be subjected to the dry heat test in accordance with **7.2** of IS : 589-1961*. The temperature of the test chamber shall be maintained at the maximum category temperature of the component. The line output transformer shall be on full load during the exposure if specified in the relevant specification. While still at the high temperature and during the last half hour of exposure,

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*Basic climatic and mechanical durability tests for components for electronic and electrical equipment (*revised*).

the insulation resistance shall be measured and shall be not less than the values specified in the relevant specification. After recovery the line output transformer shall be visually examined for any damage or deterioration. The insulation resistance measured shall not be less than the value specified in the relevant detail specification.

7.9.3 *Damp Heat (Cyclic) (First Cycle)* — The line output transformer shall be subjected to the first cycle of the damp heat (accelerated) test in accordance with **7.4** of IS : 589-1961*. The duration of the recovery period shall be one and a half hours. After recovery the line output transformer shall be visually examined for any damage or deterioration.

The insulation resistance shall be measured and it shall not deviate from the values obtained therein.

7.9.4 *Cold Test*—The line output transformer shall be subjected to the cold test in accordance with **7.1** of IS : 589-1961*. The temperature of the chamber shall be maintained at the minimum category temperature of the component. The duration of recovery period shall be one and a half hours. After recovery, the line output transformer shall be visually examined and there shall not be any damage or deterioration. The following tests shall be carried out :

a) Continuity of windings, and

b) Voltage proof.

7.9.5 *Air Pressure (Low)*—The line output transformer shall be subjected to low air pressure test in accordance with **7.12** of IS : 589-1961*. The pressure shall be appropriate to the category and the duration shall be 5 minutes. There shall be no electrical failure or mechanical deterioration.

7.9.6 *Damp Heat (Cyclic) (Remaining Cycles)* — The line output transformer shall be subjected to the remaining number of cycles of damp heat (accelerated) in accordance with **7.4** of IS : 589-1961*. After the recovery of 24 hours the line output transformer shall be subjected to visual examination and the continuity of windings is tested. There shall not be any apparent damage or illegibility of markings and the windings shall be continuous.

The line output transformer shall then be subjected to dc resistance, inductance, voltage proof and insulation resistance tests. The values shall not be less than those specified in the relevant specification.

7.10 Damp Heat (Long Term Exposure) — The line output transformer shall be subjected to damp heat (long term exposure) test in accordance with the category of the component under test.

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*Basic climatic and mechanical durability tests for components for electronic and electrical equipment (*revised*).

During the test, loading if required, shall be specified in the relevant specification. After recovery, the line output transformer shall be subjected to visual examination and the continuity of windings is tested. There shall not be any apparent change. The marking shall be legible and the windings shall be continuous.

The line output transformer shall then be subjected to dc resistance, inductance, voltage proof and insulation resistance tests. The values shall not be less than those specified in the relevant specification.

7.11 Mould Growth — The line output transformer shall be subjected to mould growth test in accordance with **7.9** of IS : 589-1961*. At the end of the test the line output transformer shall be subjected to visual examination and the continuity of windings. There shall not be any apparent damage, the markings shall be legible and the windings shall be continuous.

7.12 Salt Mist — The line output transformer shall be subjected to salt mist test in accordance with **7.10** of IS : 589-1961*. The duration of exposure shall be 4 days. After cleaning and recovery, the line output transformer shall be subjected to a visual examination and the continuity of windings shall be tested. There shall be not any apparent damage, the markings shall be legible and the windings shall be continuous.

7.13 Shock (When Specified) — The line output transformer shall be subjected to shock test in accordance with **7.5** of IS : 589-1961*. At the end of the test the line output transformer shall be subjected to visual examination and the continuity of windings. There shall not be any apparent damage, the marking shall be legible and the windings shall be continuous.

The line output transformer shall then be subjected to dc resistance, inductance, insulation resistance and voltage proof tests. The values shall not be less than those specified in the relevant specification.

7.14 Acceleration (When Specified) — The line output transformer shall be subjected to acceleration test in accordance with **7.7** of IS : 589-1961*. At the end of the test the line output transformer shall be subjected to visual examination and the continuity of windings. There shall not be any apparent damage, the marking shall be legible and windings shall be continuous.

The line output transformers shall then be subjected to dc resistance, inductance, voltage proof and insulation resistance tests. The values shall not be less than those specified in the relevant specification.

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*Basic climatic and mechanical durability tests for components for electronic and electrical equipment (*revised*).

7.15 Endurance (Electrical) — The line output transformer shall be mounted in accordance with detailed specification. The windings shall be loaded as in dynamic performance test at its rated voltage and current. The test shall be carried out at the maximum category temperature and the duration of this test shall be 1 000 hours, unless otherwise specified. At the end of 1 000 hours period, the line output transformer shall be allowed to cool under atmospheric condition for testing. The line output transformer shall then be subjected to visual examination and continuity of windings. There shall not be any apparent damage, the markings shall be legible and the windings shall be continuous.

The line output transformer shall further be subjected to dc resistance, inductance, voltage proof and insulation resistance tests. The values shall not be less than those specified in the relevant specification.

7.16 Flammability — The tests shall be carried out on line output transformer as per the procedure given in Appendix A.

APPENDIX A

(*Clause* 7.16)

A-1. OBJECT

A-1.1 This test is intended to determine whether line output transformers will support combustion.

A-2. TEST CHAMBER

A-2.1 The chamber used for this test shall have the following provisions :

a) An enclosure protected from air currents, but provided with means of venting fumes and admitting an adequate supply of fresh air at the bottom.

Note 1 — A metal box about 600 mm wide, 900 mm high and 600 mm deep, with a detachable front, a viewing window and suitable holes for intake of air and venting of fumes can be used.

Note 2 — Adequate safety precautions shall be taken to protect personnel from possible explosion of the components.

b) A suitable stand or support for the line output transformer involving a minimum of heat transfer; and

c) A spirit burner of the pattern shown in Fig. 3 or of any other pattern. The fuel for the burner shall be of good quality 66° OP industrial methylated spirit containing not more than 5 percent of wood naphtha (*see* IS: 324-1959*). The burner and the flame are considered satisfactory if a bare copper wire 0·71 mm dia having a free length of not less than 100 mm in the flame in the position to be occupied by line output transformer melts in less than 6 seconds.

NOTE — The melting point of copper is 1 083°C

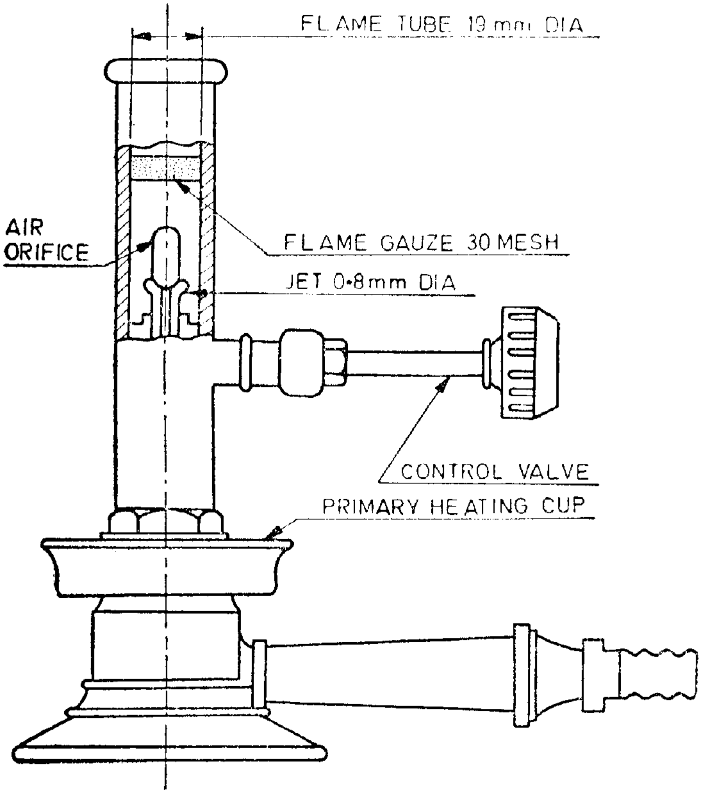

FIG. 3 SPIRIT BURNER

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*Specification for ordinary denatured spirit (*revised*).

A-3. MOUNTING

A-3.1 The line output transformer shall be mounted on the stand placed within the test chamber, in such a manner, that it is not shielded from the flame by the support. The precise orientation of the line output transformer relative to the flame, if not stated in the relevant specifications, shall be that judged to be the most unfavourable or which presents maximum surface to the test flame.

A-3.2 The height of the line output transformers shall be so adjusted that the lowest part of the component body is 51 mm from the top of the burner as shown in the Fig. 4.

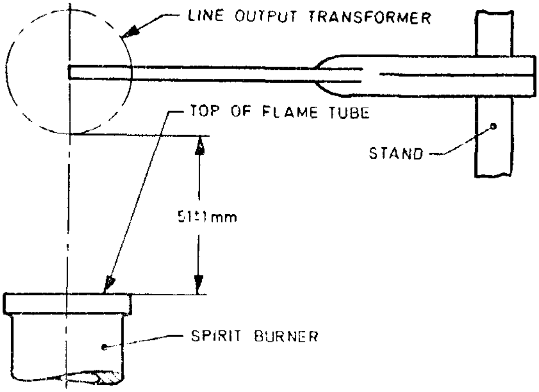

FIG. 4 RELATIVE POSITION OF BURNER AND COMPONENT

A-4. TESTING

A-4.1 After confirming that the flame is satisfactory as specified in **A-2.1** (c), the burner shall be placed underneath the line output transformer in such a manner that it is enveloped by the flame. The line output transformer shall be exposed to the flame for either one minute or any less time necessary to cause ignition.

A-4.2 If ignition has occurred, it shall not continue for more than 15 seconds or any other period specified in the relevant specification after withdrawal of the flame.

A-5. REQUIREMENT

A-5.1 Burning particles shall not detach from the line output transformer.